

Customer No.: 31561
Application No.: 10/604,794
Docket No.: 9725-US-PA

REMARKS

Present Status of Application

Claims 1-25 remain pending in the application. The Office Action mailed on December 18, 2003, objected the title for not being descriptive. Claims 1-25 were rejected under 35 USC § 103(a) as being unpatentable over Applicant's Prior Art (APA) in view of Bojkov et al. (US Patent Application Publication 2003/0116845 A1).

The title has been amended. No new matter has been added to the application by the amendments made to the title. After considering the following remarks, a notice of allowance is respectfully solicited.

Discussion for 35 USC § 103 rejections

Claims 1-25 were rejected under 35 USC § 103(a) as being unpatentable over Applicant's Prior Art (hereinafter APA) in view of Bojkov et al. (US Patent Application Publication 2003/0116845 A1, hereinafter Bojkov).

As recognized by the Office Action, APA fails to show that the wettable layer is fabricated using copper and has a thickness between about 3 to about 8 microns. The Office Action relied on Bojkov for teaching the wettable layer fabricated using copper and having a thickness between 3-8 microns for the purpose of providing high speed and high density.

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Applicant respectfully traverses these rejections.

Bojkov merely discloses a method for direct bumping on copper pads. The method includes cleaning an exposed portion of copper 501, forming a copper layer 507 directly on and overlapping the exposed copper 501 and then a copper stud 508 is deposited on the copper layer 507 (Abstract and Fig. 5). The preferred thickness range of the copper layer 507 is from 0.3 to 0.8 microns, while the stud 508 has a thickness from about 10 to 20 microns (Col. 3, paragraph [0039]).

At first, nowhere in Bojkov's teachings shows a wettable layer or a wettable layer having a thickness of about 3 to 8 microns, as claimed in the present invention.

Moreover, as emphasized by Bojkov, by skipping the intermediate barrier layer of prior art, the Bojkov's structure consisting of copper stud 508, copper layer 507 and copper metallization 501 exhibits the lowest possible electrical resistance for contact pad 500, thus enhancing the high speed performance of the IC (paragraphs [0013] and [0040]). Regarding the teachings of Bojkov as a whole, Bojkov teaches a stacked structure consisting of a copper pad, a copper layer on the pad and a copper stud on the copper layer, without an intermediate barrier layer for lower resistance. Therefore, one skilled in the art will not consider to form a wettable layer of copper with a thickness of 3-8 microns over the barrier layer, because this modification, as suggested by the Office Action, is against Bojkov's purposes. Going against the objectives of Bojkov teaches

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against the proposed combination.

Further, the Office Action noted that the specification contains no disclosure of whether the critical nature of the claimed dimension or any unexpected results arising therefrom.

Applicant would like to point out that the critical nature of the claimed features, especially the dimension of the wettable layer, has been provided at least in page 7, paragraph [0021] of the specification. As explained in the specification, with the specific thickness (ranging between about 3 to about 8 microns) of the wettable layer, the reaction time between copper and tin is extended, thereby reducing the formation of a discontinuous inter-metallic layer through prolonged reaction between nickel and tin. Consequently, the bonding strength and adhesion between the bump and the chip are improved. Moreover, by concurrently using the barrier layer of a nickel/vanadium alloy and the wettable layer as claimed in the present invention, the thickness of the adhesion layer can be decreased and the bonding reliability between the bump and the chip is increased.

As a result, Applicant submits that independent claims 1, 8 and 20 patently define over the cited reference, either alone or in combination. Regarding the rejection under 35 USC 103(a), the Applicants submit that dependent claims be patentably distinguishable over the cited references for at least the same reasons as the independent claims, from

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which these claims respectively depend, as well as for the additional features that these claims recite.

In view of the above amendment and discussions, reconsideration and withdrawal of the 103 rejections are respectfully requested.

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CONCLUSION

In view of the foregoing, it is believed that all pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

Date:

March 16, 2004

Respectfully submitted,

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